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A NEW WIND ALARM

The havoc caused by high winds to life and property is only too well known. There have been a number of accidents in the Indian Railways during the past two decades when either the railway bridges have been damaged or the entire train itself blown over in sudden gusts of high winds. In order to give warning to approaching trains, high wind alarms were developed and installed on a number of vulnerable railway bridges. The present note describes the latest wind alarm system developed in the Instruments Division of the India Meteorological Department at Pune for the Indian Railways.

2. *Principle* — The wind alarm is a wind sensor-cum-warning device which will give out an audible alarm and also trip a relay which, in turn, can actuate a warning signal whenever the windspeed exceeds a present level and sustains above that level for more than two seconds. The alarm and the relay will remain on for a minimum of 10 seconds once they are actuated.

3. *Description* — The system consists of a windspeed sensor (anemometer) and an indicator alarm unit (I/A unit). These are described below :

3.1. *Anemometer* —The anemometer has been specially designed to meet the conflicting requirements of ruggedness and sensitivity. The salient feature of the anemometer is the integrally moulded light weight plastic cups. The one piece moulding in weather resistant plastic ensures that the cup assembly can withstand windspeeds greater than 200 kmph while the light weight of the cup assembly and its geometry ensure response times of the order of 0.6 seconds. Salient features of the anemometer are given below :

(a) Cup assembly	:	Precision light weight, three cup assembly, integrally moulded in weather resistant high strength plastic
(b) Speed sensing	:	Infrared sensor detector and light weight chopper
(c) Power input	:	12V DC
(d) Threshold windspeed	:	300 cm per second
(e) Range	:	0 to 200 kmph.

The mechanical details of construction are shown in Fig. 1. The cup assembly (a) is fixed to the shaft (b) by means of a threaded cap (c). The other end of the shaft carries a slotted disc (d) which rotates freely in a slotted infrared emitter/detector (e). Precision ball bearings support the shaft. When the cups rotate, pulses are produced in the IR sensor and these are amplified by a two stage transistor amplifier (f) and presented as a pulsating current to a three pin connector (g). This transducer unit can be removed by unscrewing and sliding down the outer cover after loosening the retainer screw (h) and then unscrewing the connector (m). The connecting cable comes out through the holder (r) of the anemometer and is connected to the indicator alarm unit.

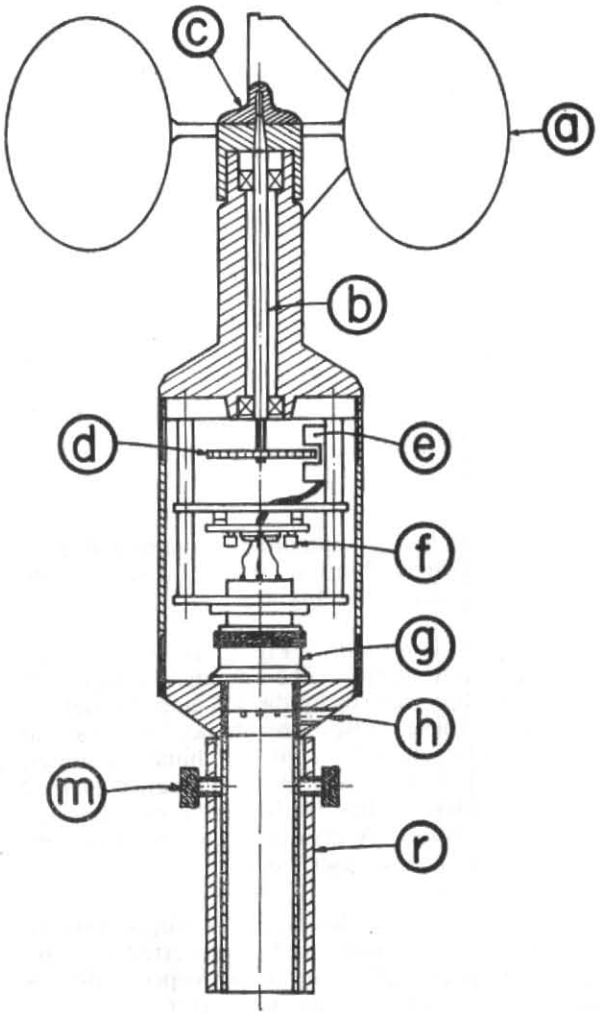

Fig. 1. Mechanical details of construction of anemometer

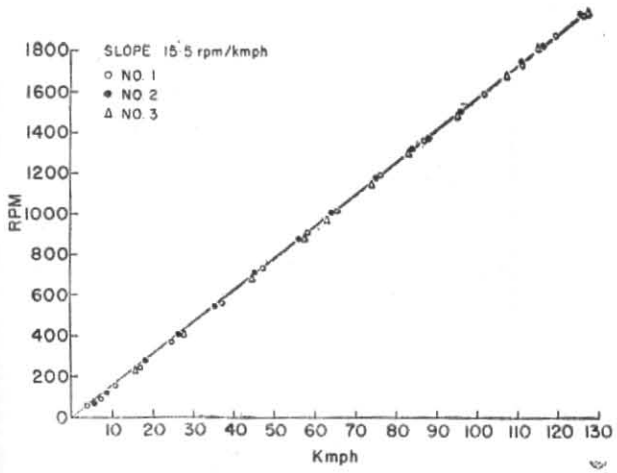

Fig. 2. Anemometer calibration

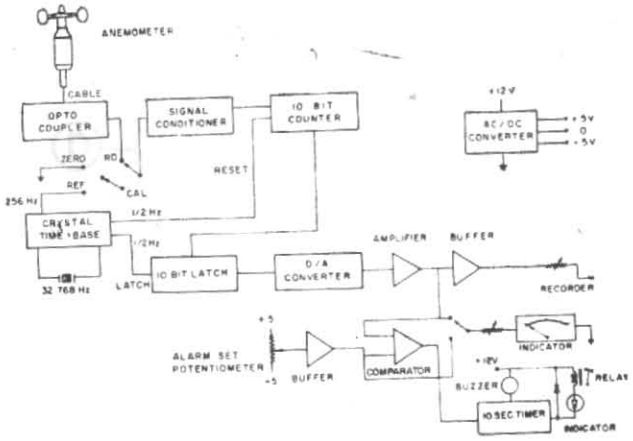

Fig. 3. Block diagram of wind alarm

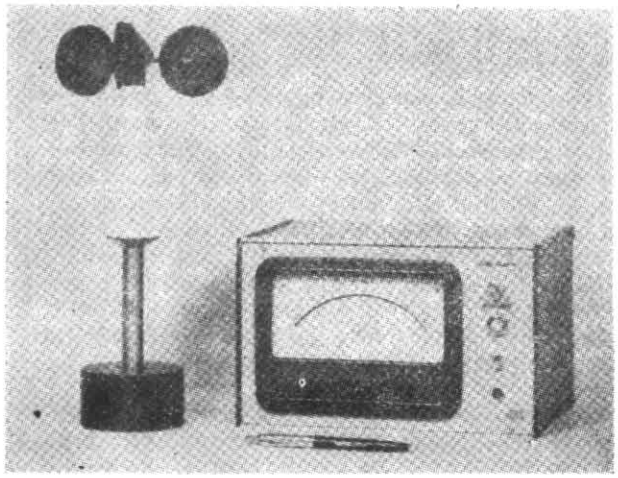

Fig. 4. Photograph of wind alarm

The anemometers are individually calibrated in a wind tunnel. Their calibration curves are very nearly linear as can be seen from Fig. 2.

3.2. *Indicator alarm unit* — Fig. 3 gives the block diagram of the wind alarm. The amplified pulses from the anemometer are received by the I/A unit through an opto isolator. These pulses are shaped in a signal conditioner and counted by a 10 bit binary counter. The count received is latched in 4 bit latches every 2 seconds. Immediately after latching, the counters are reset by a reset pulse. A crystal clock provides both the 2 second latch and reset pulses.

The output form the latches which is proportional to the integrated 2 second windspeed is converted to a DC voltage by a D/A converter and after proper scaling is displayed in kmph in the indicator meter.

The alarm is actuated by the comparator output, the inputs of which are the windspeed analog voltage and the alarm set voltage. The comparator drives a ten second timer which switches on a relay and sets off an audible alarm. The change over contacts of the relay can be used to switch any automatic signalling system. The buzzer and the alarm relay will remain on for a minimum period of 10 seconds. A third amplifier gives output suitable for a strip chart recorder. A built-in 'calibration check' facility is provided for the I/A unit. The alarm threshold can be set at any desired value by a potentiometer on the front panel.

Fig. 4 Shows a photograph of the wind alarm.

4. The authors would like to thank Dr. G.P. Srivastava, for his keen interest in the project and his encouragement during the design and fabrication stages of the equipment.

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